DOCUMENT RESUME

ED 252 821 CS 007 891

AUTHOR Fry, Edward
TITLE Spectograms: A Search for the Physical Evidence between Written and Spoken Language.
PUB DATE Dec 84
NOTE 7p.; Paper presented at the Annual Meeting of the National Reading Conference (34th, St. Petersburg, FL, December 6-8, 1984).
PUB TYPE Viewpoints (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Oral Language; *Phonemes; Reading Instruction; *Sound Spectrographs; *Visible Speech; *Written Language
IDENTIFIERS Words

ABSTRACT

Spectographic analysis of speech calls into question two common assumptions of reading teachers: (1) that words are independent units of speech, and (2) that phonemes, the minimal speech sounds needed to change meaning, actually exist. Spectographs reproduce the physical sounds made in speech without any human or psychological interpretation. When a short sentence is spoken into the machine, it shows clearly that words are not physically separated. Similarly, phonemes do not show up on the spectograph as independent units. This paper does not argue that "words" and "phonemes" do not exist; rather, it argues that they do not exist in a pure or unambiguous state in physical reality. Teachers need to be aware of this lack of physical separation for spoken words and phonemes, and of the fact that the separation occurs in the receiver's mind, not in the physical sound. This phenomenon may well explain some of the difficulties encountered in teaching reading to young children, adults, and second language students. (RBW)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

ED252821

SPECTOGRAMS: A SEARCH FOR THE PHYSICAL EVIDENCE BETWEEN WRITTEN AND SPOKEN LANGUAGE

by

Edward Fry

Reading Center
Rutgers University
New Brunswick, New Jersey 08903

Paper presented at
The National Reading Conference
St. Petersburg, Florida
December, 1984

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Edward Fry

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

CS 007891

Edward Fry
Rutgers University

SPECTOGRAMS: A SEARCH FOR THE PHYSICAL EVIDENCE BETWEEN WRITTEN AND SPOKEN LANGUAGE

It is widely assumed by the lay person that writing "ain't nothing but speech written down." Linguists or even secretaries who have transcribed oral presentations, however, will report that oral language is a good deal less formal, and relaxed or incomplete sentence structure often predominates.

Most persons assume that there is something called a "word" and furthermore that it has some kind of physical and psychological reality. The Thordike Century Senior Dictionary defines a "word" as "a sound or group of sounds that has meaning and is an independent unit of speech." The spectogram calls into question the common assumptions, particularly that it is "an independent unit of speech."

Teachers and linguists also deal with a unit of speech called a "phoneme." Phonics is the learning of grapheme (written unit) and phoneme (spoken unit) correspondence. Phonemes are defined as the minimal speech sound needed to change meaning. The difference between

/pin/ and/per./ is often cited as an example of a phoneme change which changes meaning. In phonics instruction graphemes which are written letters or groups of letters are taught together with the individual phoneme. Hence there is an assumption that something like a phoneme exists. The spectogram also calls this assumption into question.

It is not the purpose of this paper to argue that "words" and "phonemes" do not exist but rather to argue that they do not exist in a pure or unambitious form in physical reality.

The modern spectogram is made by a complicated computer-controlled instrument for making sound visible. That is it will plot speech or any sound on a graph which can be displayed on a cathode ray tube or printed out on paper. The graph takes the form of the familiar upper right-hand quadrant of the Cartesian coordinate system with the X axis following the usual convention of indicating increasing time from left to right. The Y axis (vertical) indicates sound frequency with low frequency sounds like /m/ appearing at the bottom of the graph and high frequency sounds like /s/ appearing at the top of the graph. A third variable of intensity (loudness) is indicated by density of pixels (blackness) on the graph.

It is perhaps redundant but nonetheless germane to the thesis of this paper that the spectograph is a machine. That is it reasonably reliably reproduces the physical sounds made in speech without any human or psychological interpretation.

When a short sentence is spoken into a spectograph, the first thing that becomes obvious is that there is not any physical separation between

words. The spectograph does not verify that a word is "an independent unit of speech."

Perhaps the assumption that words are independent units of speech came from the introspection of literate persons. If one takes a preliterate person, say a child of about 5 years of age, who has not learned to read or write but nonetheless has learned to count quite accurately up to 10, and asks the child, "How many words are in the following sentence? 'He went to the store and bought ice cream.'" The child will answer seven or five or ten. In other words, the preliterate does not know what a word is, and neither does the spectograph.

The meaning definition of a word can also be questioned in some instances. In the example of a contrast between A DOG and DOGS, any literate person would say that A DOG is two words and DOGS is one word, yet one would be hard pressed to show how the A had more meaning than the S yet S cannot be considered a word because of writing syntax. Hence words are, at least in part, a writing convention. In writing there is almost always a physical (visual) space between words and this is perhaps why it is so often assumed that there is a physical (temperal) space between spoken words.

In the spectograph in Figure 1, there is an obvious physical space near the beginning but it is caused by the phoneme /t/ which is pause (cessation) of sound followed by a rush of air.

Phonemes like words do not show up on the spectogram as indepedent units and as most phonics teachers will tell you, they need to be taught -- that is, they flunk the preliterate 5-year-old test. An examination of

the spectogram in Figure 1 shows no separation for phonemes.

The spectogram does show a vast difference in visual appearance between different phonemes and a similarity between similar phonemes. There is similarity between the long /o/ sound in low and the long /o/ sound in row, though an obvious different intensity can be caused by the speaker and/or a different position in the sentence.

All of the implications for spectogram evidence for language research and the teaching of reading and writing are not clear, but at least researchers and teachers need to be aware of the physical lack of separation for spoken words and phonemes. This might help to explain some of the difficulties in teaching reading to some young children, some adults and some ESL students.

This paper is not arguing that words in isolation should or should not be taught or that phonemes in isolation should or should not be taught, but if they are taught, they perhaps need to be taught as entities because the separation occurs in the receiver's mind, not in the physical sound.

Note: Spectograms are an important part of computer speech recognition research. The author wishes to thank Voice Processing, Inc., of Cambridge, Massachusetts, and Christopher Fry, programmer for the spectogram in Figure 1.

FIGURE 1

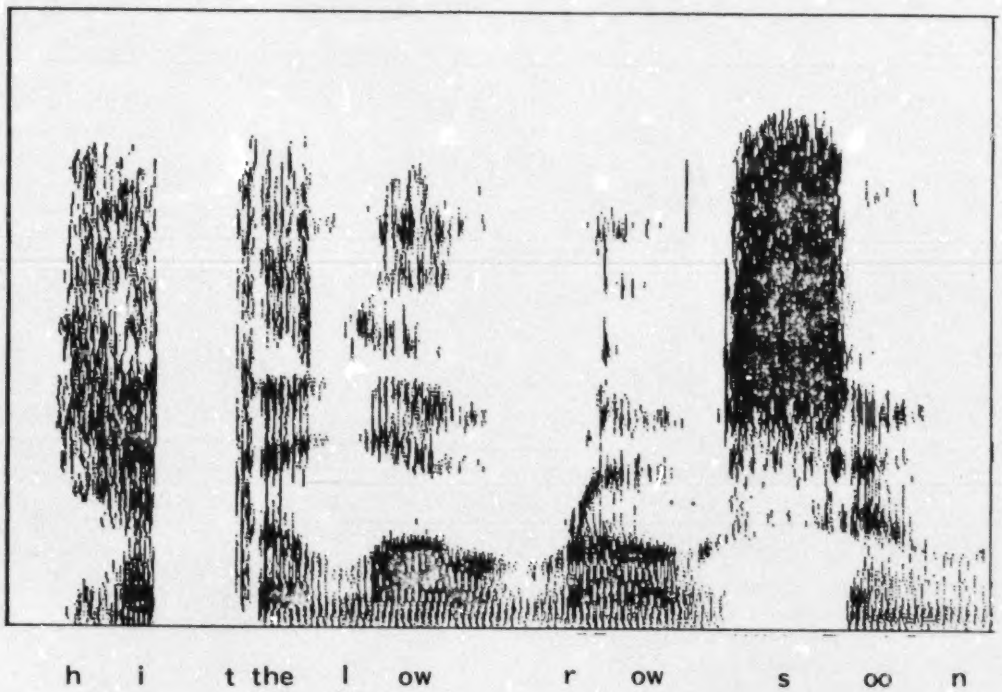

Figure 1. A spectogram of a male voice saying, "Hit the low row soon." Placement of letters across the bottom is only approximate.

BEST COPY AVAILABLE